

CLAIMS:

1. A laser scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data which includes, at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the product item, the scanning device including:
 - (a) a housing adapted to be held by a user in use;
 - (b) a laser for emitting a scanning beam from the housing, the scanning beam being directed in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch, the scanning patch being provided in the sensing region such that it exposes at least one coded data portion;
 - (c) a sensor for sensing the at least one exposed coded data portion;
 - (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.
2. The scanning device of claim 1, wherein the housing includes:
 - (a) a grip for holding by the user; and,
 - (b) a nose having an aperture for emitting the radiation and for receiving radiation reflected from product items in a sensing region.
3. The scanning device of claim 1, wherein the scanning device includes an input control, and wherein the sensor is adapted to sense the coded data upon activation of the input control by at least one of:
 - (a) a user; and,
 - (b) physical contact between the housing and the product item.
4. The scanning device of claim 3, wherein the input device includes a trigger, the scanning device being adapted to sense coded data in response to activation of the trigger by the user.
5. The scanning device of claim 1, wherein the coded data encodes an EPC associated with the product item, and wherein the processor determines the EPC.
6. The scanning device of claim 1, wherein the product identity data distinguishes the product item from every other product item.
7. The scanning device of claim 1, wherein the processor generates scan data representing the identity of the product item.
8. The scanning device of claim 7, the scan data being the product identity data.
9. The scanning device of claim 7, wherein the processor:
 - (a) determines the product identity data of the product item during a scan event; and,

(a) generates the scan data if the determined product identity data is different to product identity data determined during previous scan events.

10. The scanning device of claim 1, wherein the processor:

(a) compares the determined product identity data to previously determined product identity data; and,

(b) generates scan data representing the identity of the product item if the determined product identity data has not been previously determined.

11. The scanning device of claim 1, wherein the coded data is redundantly encoded.

12. The scanning device of claim 11, wherein the processor is adapted to use the redundantly encoded coded data to detect one or more errors in the coded data.

13. The scanning device of claim 12, wherein, in response to the detection of one or more errors, the scanning device performs at least one of:

(a) correcting the one or more detected errors;

(b) signaling a failed scan; and,

(c) ignoring the coded data.

14. The scanning device of claim 11, wherein the coded data is redundantly encoded using Reed-Solomon encoding.

15. The scanning device of claim 1, wherein the coded data is indicative of a plurality of reference points.

16. The scanning device of claim 15, wherein each reference point corresponds to a respective location on the interface surface, and wherein the processor generates position data representing the position of a sensed reference point on the interface surface.

17. The scanning device of claim 1, wherein the interface surface includes at least one region, the region including coded data indicative of an identity of the region, and wherein the processor determines the identity of the at least one region from at least some of the sensed coded data.

18. The scanning device of claim 17, wherein the at least one region includes at least one coded data portion, and wherein the coded data portion is indicative of the region identity.

19. The scanning device of claim 1, wherein the coded data portion is indicative of an identity of the interface surface and the position of the coded data portion on the interface surface, and wherein the processor uses the sensed coded data portion to thereby:

- (a) determine the identity of the interface surface;
- (b) determine position data representing at least one of:
 - (i) a position of the sensed coded data portion on the interface surface; and,
 - (ii) a position of the scanning patch relative to the interface surface;
- (c) determine a description of the interface surface using the determined identity; and,
- (d) identify the at least one region from the description and the position data.

20. The scanning device of claim 17, wherein the at least one region represents a user interactive element.

21. The scanning device of claim 1, wherein the interface surface is printed using a printer, to print the information and coded data substantially simultaneously.

22. The scanning device of claim 1, wherein the scanning device includes at least one deflector for deflecting the scanning beam in the first and second orthogonal directions to thereby generate the raster scan pattern over the scanning patch.

23. The scanning device of claim 22, wherein the at least one deflector includes at least one of: a rotating holographic element;

- (a) first and second acousto-optic deflectors; and,
- (b) resonant scanning mirrors.

24. The scanning device of claim 23, wherein the scanning device includes an amplitude modulator, positioned between the laser and the at least one deflector, for modulating the amplitude of the scanning beam.

25. The scanning device of claim 24, wherein the scanning device:

- (a) determines from radiation sensed by the sensor, using the modulation of the scanning beam, ambient light incident on the sensor;
- (b) determines from radiation sensed by the sensor, using the determined ambient light incident on the sensor, the radiation reflected from the interface surface; and,
- (c) senses the coded data from the radiation reflected from the interface surface.

26. The scanning device of claim 24, wherein the scanning device includes a focussing element positioned between the amplitude modulator and the at least one deflector for focussing the beam.

27. The scanning device of claim 1, wherein the scanning device includes a filter for filtering radiation incident on the sensor, the filter being at least one of:

- (a) a near infrared filter;
- (b) a bandpass filter; and,

(c) a longpass filter.

28. The scanning device of claim 1, the scanning device being adapted to detect the presence of a plurality of product items in the sensing region.

29. The scanning device of claim 28, wherein the processor is adapted to:

- (a) determine the presence of two or more coded data portions during a scanning event;
- (b) determine product identity data corresponding to each detected coded data portion; and
- (c) activate an alarm if the determined product identity data is indicative of more than one product item.

30. The scanning device of claim 1, the coded data being disposed on or in a substrate in accordance with at least one layout, the layout having at least order n rotational symmetry, where n is at least two, the layout including n identical sub-layouts rotated $1/n$ revolutions apart about a centre of rotational symmetry of the layout, the coded data disposed in accordance with each sub-layout including rotation-indicating data that distinguishes the rotation of that sub-layout from the rotation of at least one other sub-layout within the layout.

31. The coded data of claim 30, wherein the rotation-indicating data of each sub-layout is adapted to distinguish the rotation of the sub-layout from the rotation of each other sub-layout.

32. The scanning device of claim 30, wherein each coded data portion has a plurality of codewords arranged in accordance with a respective layout, the plurality of codewords being indicative of the identity of the product item.

33. The scanning device of claim 32, wherein each sub-layout has at least one codeword that is different to the codeword of each other sub-layout.

34. The scanning device of claim 32, wherein each layout has at least one codeword that is different to at least one codeword of at least one other layout.

35. The scanning device of claim 32, wherein each layout has at least one codeword that is identical to at least one codeword of at least one other layout.

36. The scanning device of claim 32, wherein each codeword is formed from a number of data elements arranged in accordance with a respective sub-layout.

37. The scanning device of claim 36, wherein the data elements are arranged such that each data element has a unique position.

38. The scanning device of claim 37, wherein the positions of the data elements of respective sub-layouts are interleaved.

5 39. The scanning device of claim 1, the coded data being disposed on or in a substrate in accordance with at least one layout, the layout having at least order n rotational symmetry, where n is at least two, the layout encoding orientation-indicating data comprising a sequence of an integer multiple m of n symbols, where m is one or more, each encoded symbol being distributed at n locations about a centre of rotational symmetry of the layout such that decoding the symbols at each of the n orientations of the layout produces n representations of the orientation-indicating data, each representation comprising a different cyclic shift of the
10 orientation-indicating data and being indicative of the degree of rotation of the layout.

40. The scanning device of claim 39, wherein each coded data portion has a plurality of codewords arranged in accordance with a respective layout, the plurality of codewords being indicative of the identity of the product item.

15 41. The scanning device of claim 40, wherein the coded data includes a plurality of layouts of two or more layout types, each layout encoding its layout type

20 42. The scanning device of claim 41, wherein each layout encodes a distributed codeword wherein fragments of the distributed codeword are distributed between the two or more layout types in a predetermined manner such that the distributed codeword can be reconstructed from fragments located in a plurality of adjacent layouts of different types

25 43. The scanning device of claim 1, wherein the coded data is printed on the interface surface in infrared ink, and the scanning beam is an infrared scanning beam.

44. The scanning device of claim 1, wherein the scanning device senses coded data from the interface surfaces of a number of product items substantially simultaneously.

30 45. The scanning device of claim 1, wherein the scanning device further includes a memory for storing the product identity.

46. The scanning device of claim 1, wherein the interface surface is at least one of:

- 35 (a) product item packaging;
(b) product item labelling; and,
(c) a surface of the product item.

47. The scanning device of claim 1, wherein the coded data is disposed over at least one of:

- 40 (a) substantially all of any one of:
(i) the entire product surface;

- (i) the packaging; and,
 - (ii) the label;
- (b) more than 25% of any one of:
 - (i) the entire product surface;
 - (ii) the packaging; and,
 - (iii) the label;
- (c) more than 50% of any one of:
 - (i) the entire product surface;
 - (ii) the packaging; and,
 - (iii) the label; and,
- (d) more than 75% of any one of:
 - (i) the entire product surface;
 - (ii) the packaging; and,
 - (iii) the label.

48. A method of scanning an interface surface provided on a product item, the interface surface having disposed thereon coded data which includes, at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the product item, the method including:

- (a) holding a grip portion of a scanning device housing;
- (b) activating the scanning device to thereby cause a scanning beam to be emitted from the housing, the scanning beam being directed in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch; and,
- (c) directing the scanning beam at the product item such that the scanning patch exposes at least one coded data portion, the scanning device being responsive to:
 - (i) sensing the at least one exposed coded data portion; and,
 - (ii) generating, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

49. The method of claim 48, wherein the scanning device includes an input control, and wherein the method including activating the scanning device by activating the input control.

50. The method of claim 49, wherein the input control is activated by physical contact between the housing and the product item.

51. The method of claim 49, wherein the input device includes a trigger, the method including activating the input control by depressing the trigger.

52. The method of claim 48, wherein the coded data encodes an EPC associated with the respective product item, and wherein the processor determines the EPC from the sensed coded data.

53. The method of claim 48, wherein the method includes directing the scanning beam at a number of product items substantially simultaneously, and wherein the scanning device is responsive to sense coded data from the interface surfaces of the number of product items substantially simultaneously.

- 5 54. A system incorporating a first laser scanning device as claimed in claim 1 and a second laser scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon or therein coded data which includes, at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the product item, the product item being provided in a sensing region, the second laser scanning device including:
- 10 (a) a laser for emitting at least one scanning beam, the scanning beam being directed in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch, the scanning patch being provided in the sensing region such that it exposes at least one coded data portion;
- (b) a sensor for sensing the at least one exposed coded data portion; and
- 15 (c) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

55. A system incorporating a laser scanning device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:
- 20 (a) a beam generator for emitting at least one scanning beam, the scanning beam being directed in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch provided in the sensing region;
- 25 (b) at least one beam controller for directing the at least one scanning beam along selected ones of a number of patch beam paths, each patch beam path extending into the sensing region at a respective angle;
- (c) a sensor for sensing at least some of the coded data on the interface surface of the product item as the product item passes through the sensing region; and
- 30 (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

56. A system incorporating a laser scanning device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:
- 35 (a) a beam generator for generating at least one scanning beam having a predetermined spectrum;

(b) at least one beam controller for directing the at least one scanning beam into the sensing region through a scanning surface, the scanning surface being transmissive to radiation of at least a portion of the predetermined spectrum;

(c) a sensor for sensing at least some of the coded data on the interface surface of the product item; and

(d) generate, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

57. A system incorporating a laser scanning device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:

(a) a beam generator for emitting at least one beam;

(b) first and second acousto-optic deflectors for deflecting the beam in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch;

(c) a sensor for sensing at least some of the coded data on the interface surface of the product item as the product item passes through the sensing region; and

(d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

58. A system incorporating a laser scanning device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:

(a) a beam generator for emitting at least one beam;

(b) at least one rotating holographic optical element for selectively deflecting the beam in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch;

(c) a sensor for sensing at least some of the coded data on the interface surface of the product item as the product item passes through the sensing region; and

(d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

59. A system incorporating a laser scanning device as claimed in claim 1 and a reading device adapted to read an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the reading device including:

(a) a housing for mounting on at least one finger of the user in use, the housing including an aperture;

(b) a radiation source for illuminating the interface surface of the product item;

(c) a sensor provided in the housing for sensing at least some of the coded data through the aperture when the product item is positioned substantially in contact with the housing; and

(d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

5 60. A system incorporating a laser scanning device as claimed in claim 1 and a reading device adapted to read an interface surface provided on a product item, the interface surface having disposed thereon coded data which includes, at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the product item, the reading device including:

- 10 (a) a housing adapted to be held by a user in use;
- (b) a radiation source for emitting radiation from the housing such that it exposes at least one coded data portion;
- (c) an image sensor for sensing the at least one exposed coded data portion; and
- 15 (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.